SOME EFFECTS OF PERIODIC WINTER FIRE ON PLANT COMMUNITIES ON THE GEORGIA PIEDMONT[1/]

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Abstract.-- Belt transect and planar intercept sampling were used to characterize the vegetation in two management compartments of the Piedmont National Wildlife Refuge that have been prescription burned every fourth or fifth winter since 1964 and one that has remained unburned. These fires drastically reduced plant community stature but did not alter species composition. Expressions of species frequency, density and importance were derived and compared. Results are discussed from a wildlife standpoint.

INTRODUCTION

The Piedmont National Wildlife Refuge (PNWR) covers about 35,000 acres of the lower Piedmont, 25 miles north of Macon, GA. The PNWR was created by executive order in 1939 on severely eroded land that had been farmed for cotton for over 100 years before being abandoned. Management objectives of the PNWR are to: 1) provide suitable habitat for indigenous wildlife species, 2) manage the timber resource on a sustained yield basis, and 3) serve as a demonstration area to show the results of integrating these two objectives. To facilitate accomplishment of these objectives, the refuge was divided into management compartments of roughly 1,000 acres each. The 20 to 40 acre mixed pine-hardwood stands within a compartment are managed on an approximate 80-year rotation with cuttings scheduled every 8 years once a stand reaches pulpwood size. Most compartments have been on a 4-year winter prescribed burning cycle since 1964, although 5 years have occasionally elapsed between burns because of insufficient burning weather during a given winter. Firing techniques have varied but the overriding concern has been to keep fire intensity low.

The study described here was conducted to evaluate the effects of this burning program on the vegetation after 20 years. The impact of burning on the resident fauna is briefly discussed. More detailed discussions can be found elsewhere (e.g. Benford 1968, King 1982, Speake et al 1975, and USDI Fish and Wildlife Service 1985). Changes in vegetative structure were visually obvious, but PNWR personnel wanted to quantify these changes. They wanted answers to the following questions: What are the effects upon commonly found shrubs and trees? Are any plant species being eradicated? Is pine regeneration adequate? Is the number of mast-producing trees decreasing?

METHODS

To answer these questions, we conducted a vegetative survey in two burned compartments and one adjacent unburned compartment during the summer of 1983. We chose the fourth growing season after burning because we were primarily interested in the long-term effects of the 4-year winter burning cycle. Conducting the study during an earlier postfire successional stage would have yielded a substantially higher number and amount of herbs. The response of herbaceous vegetation to fire in the lower Piedmont has previously been documented (Cushwa and others,1966; Cushwa and others, 1970; King 1982).

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Table 1.--List of minor species (species occurring on less than 5% of all transects within a survey) and total number of transects within which a minor species was encountered. Excludes those species that were minor or absent in one survey but common in the other.

Species	Total number of transects species found in Unburned Compartment	Burned Compartments
Acer leucoderme	1	1
Albizia julibrissin	3	1
Amelanchier arborea	2	0
Asimina parviflora	4	2
Campsis radicans	1	2
Carpinus caroliniana	2	0
Castanea pumila	0	2
Euonymus americanus	1	2
Fagus grandifolia	1	0
Ilex decidua	4	0
Ilex opaca	1	2
Juniperus virginiana	1	2
Magnolia acuminata	2	1
Prunus spp.	1	0
Rhododendron spp.	1	1
Rhus glabra	0	1
Sassafras albidum	0	1
Styrax grandifolia	1	0
Ulmus americana	1	0
Vaccinium arboreum	8	5
Viburnum nudum	1	1
Viburnum rufidulum	7	6
Vitus aestivalis	0	2
Unknown	3	3

Table 2.--Basal area by species, aspect, and burning treatment for woody plants greater than 4.5 ft. tall.

Species Group	NE		SE		SW		NW	
	B	U	B	U	B	U	B	U
Acer barbatum	2.2	0.2	0.0	0.2	2.4	0.8	4.0	1.1
Acer rubrum	0.3	1.1	0.7	1.7	2.6	1.5	0.7	1.2
Callicarpa americana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carya spp.	0.6	3.1	0.1	11.7	1.5	1.8	2.9	1.1
Cercis canadensis	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
Cornus florida	6.5	4.4	6.2	6.5	1.7	3.3	12.0	4.3
Crataegus spp.	1.0	0.7	0.4	0.2	0.0	0.4	0.2	0.9
Diospyros virginiana	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1
Fraxinus spp.	1.1	2.5	0.0	0.8	2.3	1.5	1.3	3.1
Liquidambar styraciflua	2.7	7.6	7.8	6.5	10.4	14.7	3.4	10.9
Liriodendron tulipifera	0.0	0.9	1.5	2.1	1.1	8.1	2.9	1.8
Morus rubra	0.0	0.0	0.0	0.3	0.0	0.6	0.3	0.0
Nyssa sylvatica	0.1	1.4	1.1	0.9	1.8	0.5	0.7	1.5
Ostrya virginiana	0.0	0.0	0.0	0.1	0.0	0.0	0.1	2.0
Pinus echinata	7.0	13.2	7.8	1.1	8.3	25.6	4.8	6.1
Pinus taeda	70.1	56.7	72.1	83.0	75.2	55.0	72.2	65.5
Prunus serotina	0.6	0.3	0.5	0.1	0.1	0.3	0.2	0.4
Quercus spp. (red oaks)	10.3	1.3	8.0	11.6	1.7	11.2	2.0	5.2
Quercus spp. (white oaks)	4.8	4.9	4.1	12.2	3.1	14.2	4.6	11.2
Rhus copallina	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Ulmus alata	3.0	2.4	7.4	0.4	0.9	1.4	0.8	1.5
Total	110.3	101.0	118.0	139.6	113.3	141.1	113.0	117.9

Two separate surveys were conducted: one for woody vegetation taller than breast height (4.5 feet above ground) and one for ground cover and vegetation less than breast height. One hundred sixty-six belt transects, each 8 feet wide by 100 feet long, were established to assess the taller vegetation. Plants less than 4.5 feet high were surveyed by the planar intercept method along the first 50 feet of each belt transect midline.

Pine and hardwood basal areas were estimated with a 10 factor prism at the 50-foot mark of each transect. Transects were located along contours at elevations between 425 and 500 feet in order to maintain position within the mid to upper third of a slope. At least 20 transects were laid out on each of four aspects: northeast, southeast, southwest, and northwest. All transects were on Davidson soils except for six that occurred on Gwinnett soils. Recent cutting had not taken place in any of the surveyed stands. The overstory was all-aged with the oldest pines over 80 years in age.

The belt transect data included all stems greater than 4.5 feet tall that originated below groundline within a transect. Each was tallied as an individual plant. On line transects, plants of all sizes were tallied whenever a stem intersected an imaginary vertical plane running from groundline to a height of 4.5 feet. If a plant had a crooked stem and intersected this plane more than once, it was tallied more than once. Each 50 foot transect was divided into 1-foot segments and the species with the largest number of interceptions within each segment recorded. When more than one stem of a species was tallied within a segment, the total number of stems of that species within the segment was also recorded. Since this number included plants taller than 4.5 feet that intersected the plane below 4.5 feet, as well as plants with crooked stems that were counted more than once, the total number of plants less than 4.5 feet tall could not be determined. If the majority of a 1-foot segment did not contain vegetation, that segment was classed as void for the purpose of determining dominance.

DATA

We found the area to be floristically diverse. Close to 100 individual species were identified and placed in 58 species groups. In some cases, species within a genus were not individually recorded. The oaks were divided into two subgenera -- Erythrobalanus (red oaks) and Leucobalanus (white oaks). Species encountered on less than 5 percent (9) of the transects within a survey were classed as minor and dropped from statistical analyses. A combined list of the minor species and species groups encountered in both surveys can be found in table 1. The total number of transects by treatment that a minor species was found in is also shown in table 1. Species or species groups common in one survey but minor or absent in the other, such as Georgia hackberry (Celtis tenuifolia Nutt.), were omitted from table 1.

For each belt transect, basal area (BA), stem density (average number of stems/acre), and stocking (the number of transects in which a species was encountered) were calculated by species. An analysis of variance (ANOVA) was performed by species to determine the effects that burning regime and transect aspect had on basal area, stem density, and stocking. If a factor was found significant ($p=0.05$), Tukeys honest significant difference test (HSD) was performed to separate individual means.

For each line transect, the number of intersections and the number of 1-foot segments dominated by each species were summarized. Relative frequency (frequency of an individual species divided by sum of the frequencies of all species) and dominance (number of one-foot segments dominated by a species) were calculated for each species by transect. ANOVA was used to determine the effects of burning and aspect on the count and dominance (Importance Value) of all planar transect vegetation.

RESULTS

Plants Greater Than 4.5 ft Tall

Of the 39 species groups identified on the belt transects, 18 were classed as minor. Fourteen minor species occurred in the unburned compartment and 9 in the burned compartments.

Basal area averaged 120 sq.ft. per acre and did not differ by burning regime or aspect (table 2). Loblolly pine (Pinus taeda L.) dominated BA on all aspects in all compartments averaging 72 sq.ft. on the burned areas and 65 sq.ft. on the unburned compartments. Shortleaf pine (Pinus echinata Mill.) was a distant second with average basal areas of 7 and 12 sq.ft. on the burned and unburned compartments, respectively. Hardwoods making up a major portion of the remaining BA included sweetgum (Liquidambar styraciflua L.), the white oak and red oak groups (Quercus spp. L.), flowering dogwood (Cornus florida L.) and hickory (Carya spp. Nutt.).

Dogwood was the most numerous species in all three compartments, comprising 23 percent of all woody plants greater than 4.5 feet tall (table 3). Sweetgum was the second most abundant species, comprising an additional 16 percent of all stems. Loblolly pine was third with 14 percent. All other species averaged less than 100 stems per acre.

Table 3.—Mean number of plants per acre by species, aspect, and burning treatment for woody plants greater than 4.5 ft. tall.

Species Group	Aspect							
	NE		SE		SW		NW	
	B	U	B	U	B	U	B	U
Acer barbatum	52	26	65	16	191	14	25	30
Acer rubrum	80	46	87	125	93	125	33	131
Callicarpa americana	5	9	0	0	27	14	3	0
Carya spp.	39	102	30	68	33	109	74	106
Cercis canadensis	0	13	16	16	3	5	19	14
Cornus florida	340	305	327	319	280	449	177	210
Crataegus spp.	52	111	8	54	5	54	19	109
Diospyros virginiana	16	37	19	22	16	11	11	25
Fraxinus spp.	29	26	3	25	11	38	52	44
Liquidambar styraciflua	153	211	188	180	335	289	133	177
Liriodendron tulipifera	0	13	16	11	8	27	22	22
Morus rubra	3	9	0	25	0	16	3	3
Nyssa sylvatica	16	15	5	27	30	14	44	44
Ostrya virginiana	0	4	0	14	0	3	16	87
Pinus echinata	21	15	30	19	41	54	22	25
Pinus taeda	91	218	131	348	125	191	117	267
Prunus serotina	18	15	16	11	8	25	8	22
Quercus spp. (red oaks)	52	26	30	27	25	41	65	30
Quercus spp. (white oaks)	54	46	38	52	30	46	44	52
Rhus copallina	18	15	0	5	49	38	0	5
Ulmus alata	78	91	52	35	25	207	65	103
Total	1115	1355	1062	1399	1334	1770	950	1503

Burning significantly reduced the number of stems per acre (table 3). The average number of stems per acre on the unburned area was 26 percent higher than the 1,115 in burned compartments. Examination of the diameter distributions of the burned and unburned areas indicated that this increase occurred in the 0.75, 1.25, and 1.75 inch classes (figure 1). Many of the rapidly growing postfire sprouts surpass 4.5 feet in height within the four growing seasons between fires accounting for the greater number of stems in the smallest diameter class (0.25 inch) in the burned compartments. The next fire then kills many of these sprouts resulting in the dramatic drop in the number of stems that reach the next larger size class on the burned areas. However, continued attrition in the smaller diameter classes in the unburned compartment resulted in roughly equal numbers of stems by the time the trees of many of the species groups reached 2 to 3 inches in d.b.h. Only one species, Florida maple (Acer barbatum Michx.), had significantly more stems in the burned compartments. Hickory, hawthorne (Crataegus spp. L.), red mulberry (Morus ruba L.), loblolly pine, and winged elm (Ulmus alata Michx.) all had significantly fewer stems in the burned areas. Hawthorne had approximately four times as many stems in the unburned compartment. There are actually more loblolly pine stems larger than 3.0 inch d.b.h. on the burned areas, but this fact is overshadowed by the preponderance of small stems in the unburned compartment (figure 2).

The ANOVA indicated that aspect significantly affected number of stems ($p=0.0399$), but Tukey's HSD test indicated that none of the four means differed. The general shapes of the diameter distribution were plotted for all four aspects and found to be similar - the reverse J of an all-age stand (e.g. figure 3). (the slight increase at 5 inches d.b.h. is due to a change in class interval from one-half to one inch). For several species, the mean number of plants per acre was found to vary significantly among aspects based on Tukey's HSD test. These species are American beautyberry (Callicarpa americana L.), dogwood, eastern hophornbeam (Ostrya virginiana Mill.), shortleaf pine, shining sumac (Rhus copallina L.), and winged elm.

Three species, Florida maple, hophornbeam, and winged elm, showed a significant interaction between burning regime and aspect (table 3). Fourteen times as many Florida maple stems less than 0.5 inch d.b.h. were tallied on the burned transects as on the unburned transects. Except for this smallest d.b.h. class, however, there was little difference in the number of Florida maples between burned and unburned compartments. Virtually all hophornbeam occurred on northwest aspects in the unburned compartment except for a few stems in the 0.25 inch diameter class that occurred on burned northwest aspects. Winged elm was common in all eight treatment/aspect combinations but a large majority occurred on unburned southwest aspects.

Three species occurred on more than 12 percent of all eight burn/aspect combinations. Dogwood had the highest stocking, ranging from 23 to 37 percent. Loblolly pine (16 to 31 percent) was next, followed by sweetgum (13 to 34 percent). Hickory was found on more than 12 percent of all

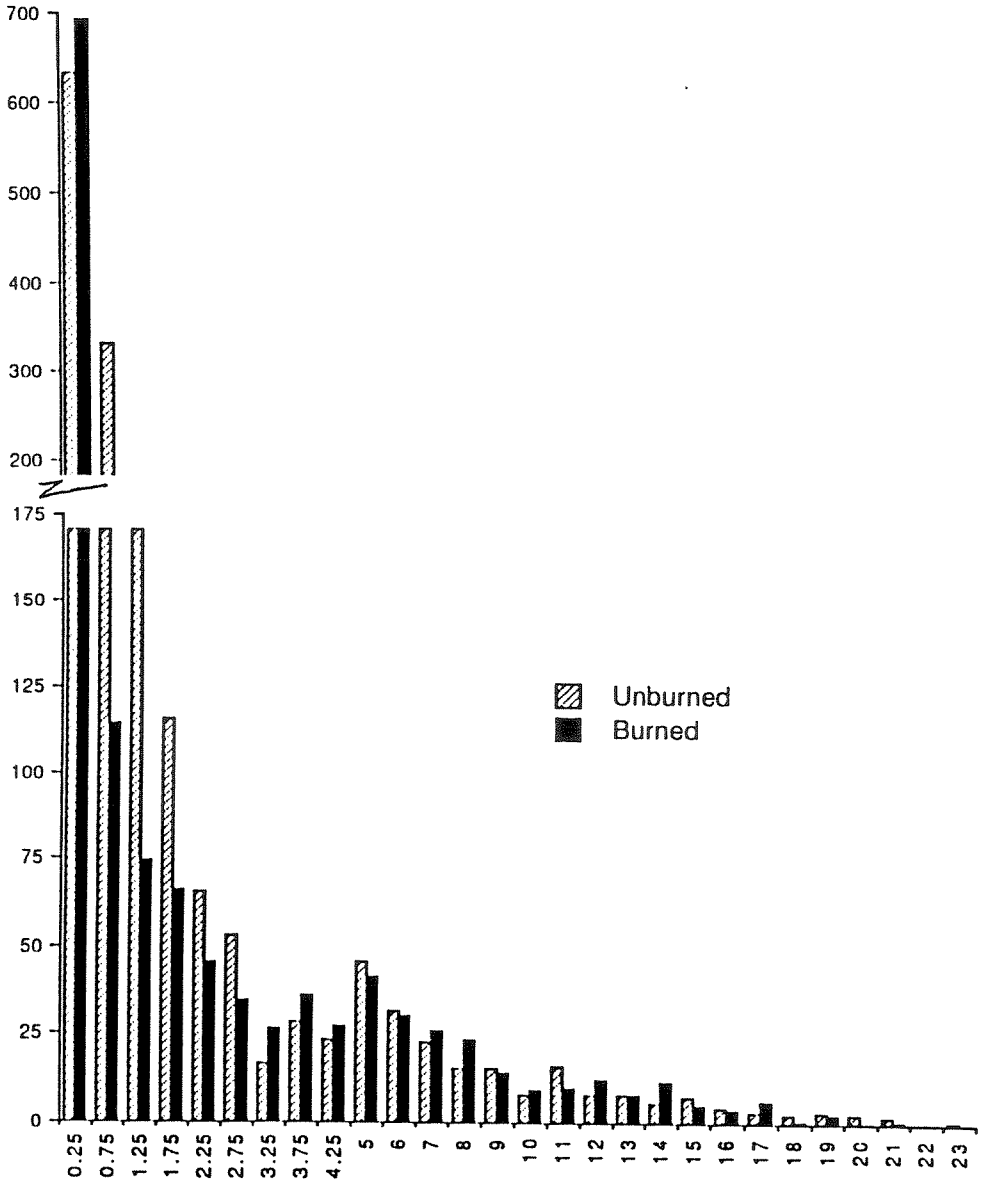

Figure 1.-- D.B.H. distributions of burned and unburned compartments.

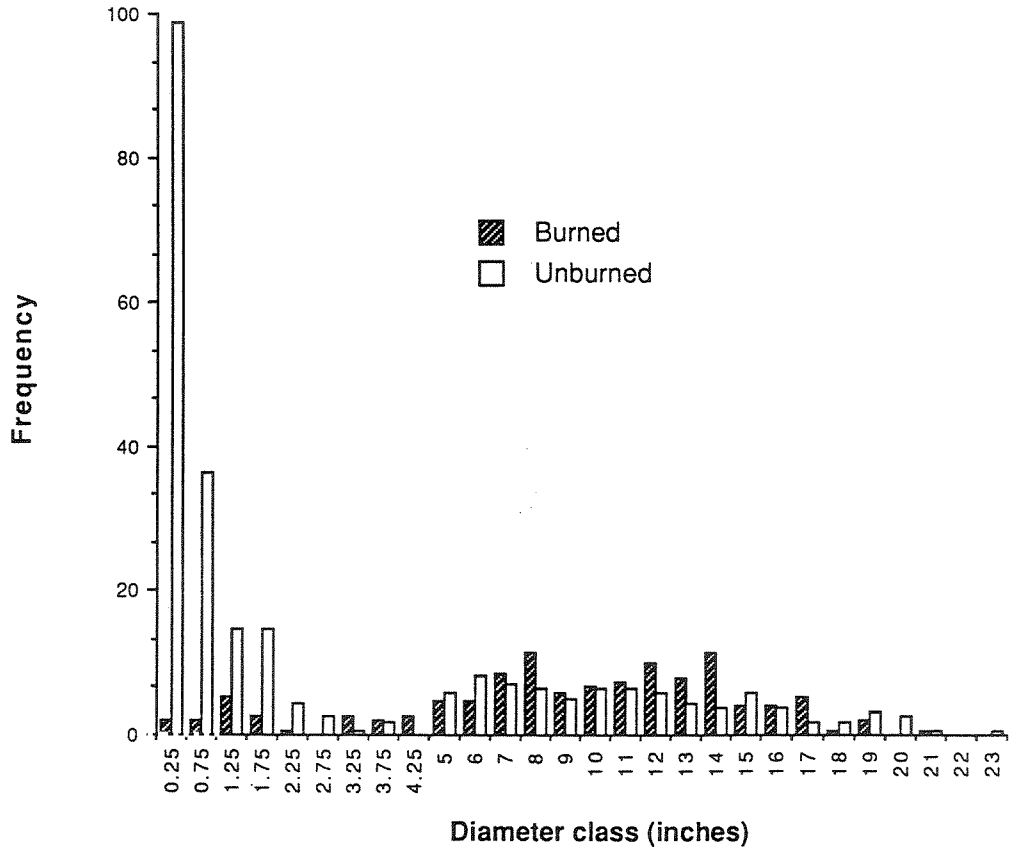

Figure 2.--Diameter distribution of loblolly pine by treatment.

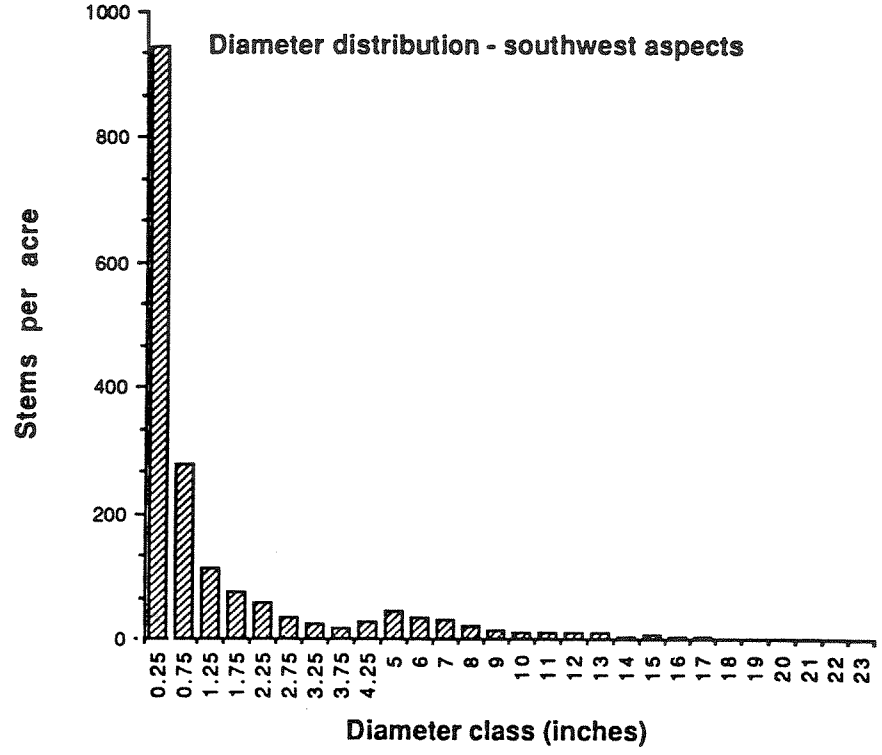

Figure 3.--Diameter distribution of all species greater than 4.5 feet tall on southwest aspects.

unburned transects but reached this level on only the northwest aspect in the burned compartments. Florida maple was found on 17 percent of the southwest burned plots. Red maple (Acer rubrum L.), hawthorne, hophornbeam, and winged elm occurred on more than 12 percent of the transects on one, two, or three aspects in the unburned compartment.

Plants Less Than 4.5 Feet Tall

Twenty-one of the 55 species groups encountered on the planar intercepts were minor and thus dropped from further analyses.

Burning significantly increased the occurrence of herbaceous plants although this species group was also the most common one on the unburned transects. This species group occurred in 50 percent of the 1-foot segments in each burned transect and in 34 percent of the segments in each unburned transect. Muscadine (Vitis rotundifolia Michx.) was the most common individual species on the burned compartments, occurring on 30 percent of the transect segments. Even though this species was also the third most common on the unburned transects (24 percent), the difference was still statistically significant. Dogwood was third on the burned areas being found on 22 percent of the segments in each transect, and second in the unburned compartments (25 percent).

Less frequently encountered species with significantly more intersections (p=0.05) on transects in the burned compartments were Florida maple (8 percent vs 2 percent), Georgia hackberry (four times as many interceptions on transects in the burned areas), Carolina jessamine (Gelsemium sempervirens L.) (virtually all on burned northwest aspects), Japanese honeysuckle (Lonicera japonica Thunb.) (the vast majority on burned northwest aspects), black cherry (Prunus serotina Ehrh.) (three times more prevalent on the burned areas), the red oak group, and greenbriar (Smilax spp. L.) (nearly twice as many on the burned areas). Although the difference was not statistically significant, the occurrence of white oaks averaged nearly 50 percent higher on the burned areas. Species with a statistically significant preference for unburned areas were hickory, loblolly pine, and the void category. The mean number of interceptions per transect by broad vegetation class are presented in table 4.

Mean number of planar transect interceptions also varied by aspect. Species with significant differences between aspects were red maple, Alabama supplejack (Berchemia scandens (J.Hill), Georgia hackberry (4 to 7 times as many on northwest aspects), hophornbeam (5 to 8 times as many on northwest aspects), and muscadine (about half as many on northwest aspects). A significant interaction between burning regime and aspect was shown for Carolina jessamine and Japanese honeysuckle.

Table 4.--Mean number of interceptions per transect by vegetation class for vegetation less than 4.5 ft tall.

Type	Burned	Unburned
Woody vegetation	40	37
Vines	25	18
Herbaceous	24	17
Void	05	10

Relative frequency is the frequency of an individual species divided by the total frequency of all species. Species with a higher relative frequency in the burned compartments on all four aspects were Florida maple, red maple, Georgia hackberry, herbs, black cherry, blackberry and dewberry (Rubus spp. L.), and viburnum (Viburnum spp. L.). Those species with a higher relative frequency on all aspects of the unburned compartment were hickory, hophornbeam, and "void".

Dominance, the number of 1-foot segments dominated by a species on a transect, varied by treatment and aspect. Muscadine, dogwood, and herbs (in descending order) had the highest values irrespective of treatment. Florida maple, Alabama supplejack (this was the only species that did not occur on all four aspects), hackberry, Japanese honeysuckle, and viburnum all had higher dominance values on all aspects (where they occurred) in the burned areas. The opposite was true of hickory, hophornbeam, loblolly pine, and "void".

Importance values (the sum of the relative frequency and relative dominance) by species, treatment, and aspect are given in table 5. Highest importance values in the burned compartments were shared by herbs and muscadine on all aspects except northwest where dogwood, Japanese honeysuckle, and "void" were all a poor second to herbs. The most important species groups on the unburned compartment were herbs, "void," and muscadine, except on the two westerly aspects where dogwood replaced muscadine.

DISCUSSION

Aspect affected the distribution, number, and size of many of the species examined in this study (tables 2,3 and 5). However, the purpose of this study was to look at fire-induced vegetative changes, so the affects of aspect will not be discussed further. Burning decreased average stem diameter because single large stems were topkilled and replaced by many small sprouts. Thus periodic burning ensures a continuous abundant supply of succulent browse at a level readily accessible to deer and other browsers. This is readily apparent in Florida

Table 5.--Importance value indices of plants less than 4.5 feet tall be species group, aspect and burning treatment.

	NE		SE		SW		NW	
	B	U	B	U	B	U	B	U
Acer barbatum	34.5	7.9	27.0	6.0	29.1	8.9	30.7	18.6
Acer rubrum	41.2	28.1	53.4	52.2	52.4	41.1	27.9	26.1
Berchemia scandens	*	*	7.5	5.4	2.0	*	4.5	*
Callicarpa americana	1.0	1.8	5.8	3.3	5.9	7.0	2.1	*
Carya spp.	12.9	25.0	13.7	18.5	9.9	17.9	10.4	13.6
Celtis tenuifolia	6.1	2.5	3.2	2.1	4.2	3.2	19.0	5.5
Cercis canadensis	2.1	2.8	5.5	8.7	9.0	2.3	15.7	2.6
Cornus florida	66.3	61.4	70.7	57.2	46.2	73.7	52.4	66.0
Crataegus spp.	17.3	17.4	19.2	13.4	29.1	9.6	1.0	17.7
Diospyros virginiana	6.4	7.4	10.0	4.6	7.8	4.4	5.6	2.3
Fraxinus spp.	4.1	6.2	2.2	*	2.1	6.4	5.5	5.6
Gelsemium sempervirens	2.0	*	*	4.0	6.1	*	30.5	*
Herbaceous	94.1	84.6	99.5	93.8	94.0	91.5	103.9	102.3
Liquidambar styraciflua	23.7	26.1	29.3	12.4	39.3	33.7	26.7	32.1
Liriodendron tulipifera	1.0	7.5	7.0	*	7.2	2.2	3.4	2.6
Lonicera japonica	8.3	*	2.1	4.1	8.0	*	55.1	2.6
Nyssa sylvatica	5.5	8.1	6.2	2.2	5.1	4.1	6.3	4.4
Ostrya virginiana	1.0	1.0	*	4.6	1.1	3.5	9.1	25.9
Parthenocissus quinquefolia	6.8	5.2	2.1	*	9.5	8.2	*	5.5
Pinus taeda	10.8	37.4	8.4	31.0	10.7	27.9	27.0	22.5
Prunus serotina	18.4	6.6	13.8	10.1	18.4	4.1	14.1	7.3
Quercus spp. (red oaks)	29.0	30.5	26.4	8.7	25.2	20.5	32.0	25.4
Quercus spp. (white oaks)	14.7	10.6	9.9	5.3	7.9	8.0	10.5	12.2
Rhus copallina	2.2	5.7	3.0	1.1	*	5.3	2.1	3.2
Rosa spp.	4.5	1.7	2.0	1.0	3.2	3.0	*	2.2
Rubus spp.	8.3	5.1	10.1	5.7	10.4	1.0	5.1	4.3
Smilax spp.	48.3	41.0	57.5	41.6	51.0	38.0	40.5	42.7
Ulmus alata	16.9	8.5	11.1	2.1	10.7	20.2	15.9	14.7
Vaccinium spp.	15.0	14.0	16.7	4.9	9.5	11.0	21.1	15.2
Viburnum spp.	2.9	0.8	2.0	*	3.3	3.3	1.0	*
Vines	*	4.7	3.0	*	*	2.1	2.1	*
Vitis rotundifolia	87.3	75.6	110.6	92.0	84.3	69.3	39.3	61.0
Void	62.1	74.2	25.9	93.6	44.0	77.9	59.9	91.4

maple, sweetgum, and redbud (Cercis canadensis L.). Substantially more vegetation was encountered on the line transects in the burned compartments while the opposite was true for the belt transects.

All common species were found in both burned and unburned compartments, but burning appeared to discriminate against some species. The hickories seem to be less tolerant of fire than other species. Although they were not eradicated by fire, their numbers were reduced in the small diameter classes on the burned areas. This reduction can be expected to have an adverse effect on nut production over time. Other midstory species adversely impacted by low-intensity winter fires at 4- to 5-year intervals include redbud, hawthorne, yellow-poplar (Liriodendron tulipifera L.), red mulberry, hophornbeam, and sumac. Fire has significantly reduced the number of loblolly pine seedlings, but sufficient stems were present to ensure this species would continue to dominate the overstory.

Each of the 58 species groups encountered in this study was put into one of three wildlife value categories: primary, secondary or none. Only one species of either primary or secondary value showed a clear response to burning in the belt transect survey (those plants over 4.5 feet tall). This was hickory which was unfavorably impacted. The situation is entirely different in the planar intercept survey. Again the only species of secondary concern to show a clear negative response to a 4-year winter prescribed burning cycle was hickory. However, nine species of primary concern showed a positive response to this prescribed fire regime. They were Georgia hackberry, black cherry, Carolina jessamine, herbs, Japanese honeysuckle, both the red and white oak groups, blackberry, greenbriar, and muscadine.

The increased abundance of both food and low-level cover resulting from periodic fire attracts a wide range of game and nongame wildlife species such as quail and turkey, and mice and shrews. Unpublished work by David Jennings shows that Cooper's hawk and the more common redtail hawk both feed primarily on the burn areas, undoubtedly because of the dramatically increased small mammal populations. Fox squirrels also favor periodically burned compartments, as do numerous song birds including the rather uncommon Bachman's sparrow.

Perhaps the most important consequence of burning on the PNWR is the beneficial relationship between fire and the red-cockaded woodpecker, a rare and endangered species whose management is dictated by law. A sparse to non-existent midstory must be maintained to favor this bird. Ongoing research on the PNWR by Dr. Lennartz shows that midstory basal area of active colonies averages 33 ft^2/ac. As the basal area approaches 55 ft^2/ac, sites are abandoned. Our study did not differentiate between mid- and over-story basal area, but if one assumes pines dominated the overstory and hardwoods the midstory (as can be inferred from Table 2), our data shows an average midstory BA of 35 ft^2/ac on the burned areas and 48ft^2/ac in the unburned compartment.

SUMMARY AND CONCLUSIONS

Approximately half of the 58 species groups encountered occurred on less than 5 percent of the transects in a survey. The 4-year winter burning cycle has retarded midstory formation, holding succession at an earlier seral stage. All common species were found in both the burned and unburned compartments. Hickory, redbud, red mulberry, eastern hophornbeam and sumac were found to be somewhat intolerant of fire. Loblolly pine dominated the overstory in all three study compartments and sufficient stems are in the understory to ensure dominance will continue in the foreseeable future. Dogwood (a tree of both aesthetic and wildlife value) and sweetgum (generally considered the major problem species on Piedmont sites being managed for pine) dominate the midstory of both burned and unburned compartments. Principal understory trees were dogwood and red maple, regardless of treatment. Florida maple was favored by burning, while understory hickories were not. Ground cover was comprised primarily of herbs, muscadine, and greenbriar across all eight treatment/aspect combinations. A much larger percentage of the forest floor was devoid of vegetation in the unburned compartment.

The total number of understory stems was increased by burning, thereby maintaining abundant wildlife browse and cover. None of the 14 species groups judged to be of primary wildlife value were adversely affected by burning. To the contrary, increased understory frequencies were noted for several "primary" species in the burned compartments. This study quantified the visual impression that 20 years of winter burning on the PNWR has drastically modified vegetative stature but has not altered composition, and that these changes have had a beneficial effect on wildlife.

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